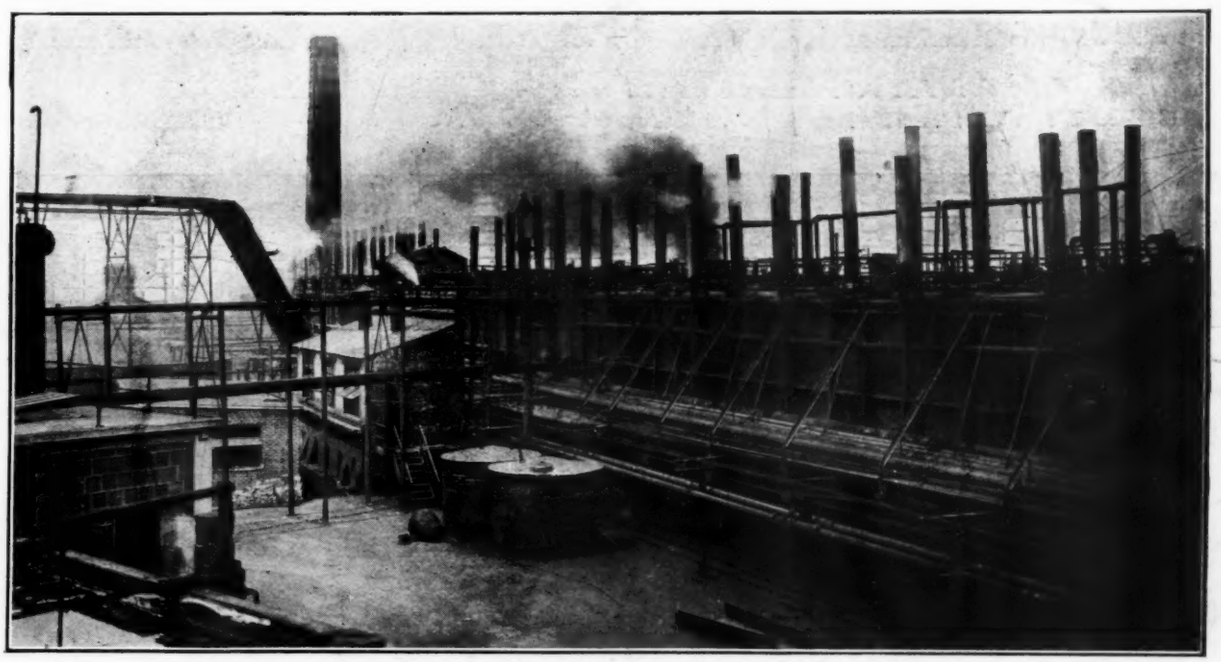
PUBLIC WORKS

CITY COUNTY STATE



BATTERY OF ASPHALT STILLS
After the asphalt has reached the consistency desired, it is pumped to storage tanks or directly to tank cars. Asphalt production, refining and handling are described in this issue.

IN THIS ISSUE

DECEMBER 18, 1920

PUBLIC WORKS

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

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Repairing Greene Ave. Sewer, Brooklyn

About 2,300 feet of brick arch of 10-foot sewer replaced by concrete in deep open cut work and about 750 feet of defective brick arch for same 10-foot sewer reinforced by concrete arch built inside old structure.

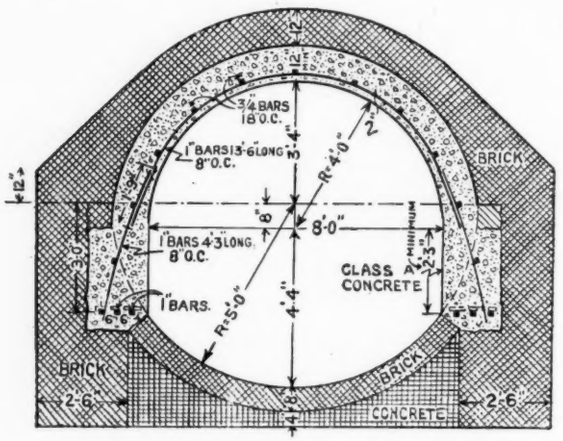
The Greene avenue sewer between Throop and Lewis avenues, Brooklyn, was a circular brick structure 10 feet in diameter inside with vertical walls 2½ feet thick, a 12-inch arch ring and an invert 8 inches thick on a concrete base 4 inches in minimum thickness. It was built many years ago at a depth of about 35 feet below the surface of the street in dry, sandy soil. Up to the springing line the sewer is still in good condition but in many places the arch has cracked, settled or broken so that it was considered unsafe, and plans were made for repairing a large portion of it.

INSIDE CONSTRUCTION

At the upper end, from Marcy avenue to Tompkins avenue, the flow in the sewer is so small that it was permissible to make a slight reduction in the cross section, and plans were made for cutting continuous longitudinal recesses 27 inches high, about 8 inches deep at the top, and about 20 inches deep at the base, below the springing

CABLEWAY HANDLING SPOIL FROM EXCAVATION TO BACKFILL STARTING SHEET PILES DRIVEN BY AIR HAMMER

line on each side of the sewer to provide for skewback courses bonded to the side walls and made continuous with a concrete arch ring 12 inches thick within the old brick arch, supporting it and resting on the skewbacks cut through the old invert and into the side walls as shown in the cross section. The roof of the reconstructed sewer thus has a radius 1 foot shorter than that of the old sewer and of the present invert, and the roof and invert are connected by vertical side walls, as shown in the cross section.



SEWER ARCH REINFORCED FROM INTERIOR

For the execution of this portion of the work, the sewer has been entered at the existing Tompkins avenue manhole, a horizontal working platform built 2 or 3 feet above the invert and clear of the sewer flow, and on it movable timber bents have been wedged up against the old cracked brick arch roof to support it when weakened by the cutting away of nearly half the thickness at each skewback alternately. All brickwork is drilled with jackhammers, cut out carefully, and the reinforcement placed in short sections first on one side of the sewer and then on the other side. As the work advances the arch timbering will be carefully replaced by heavily braced wooden forms in sections 10 feet long and the concrete will be filled in solid and brought to bear by grouting against the intrados of the old brickwork, thus giving it full support. After the concrete is sufficiently set the forms will be advanced to the next section without taking down, it will be concreted in the same manner, and so on, the concrete following closely the cutting of the skewback recesses. It is expected that when under full headway this work with a force of about seven men will be advanced at the rate of about 30 feet of completed tunnel arch per week.

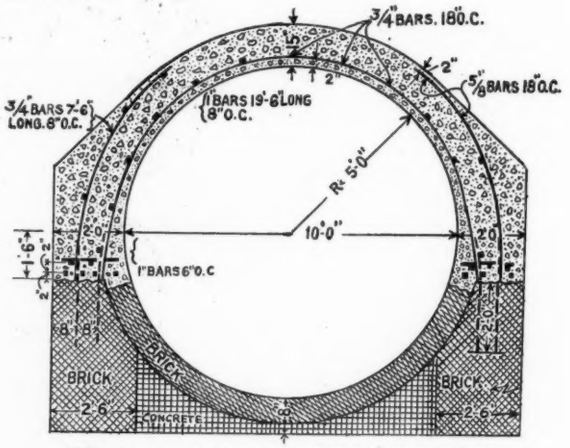
OPEN CUT WORK

For a distance of about 2,300 feet from Lewis avenue the old brick arch will be entirely removed and replaced by a reinforced concrete arch 15 inches thick, resting on the old side walls and invert 18 inches below the springing line. This reconstruction is done entirely in an open cut averaging about 25 feet deep from the surface of the street to the top of the arch and commanded by a Ridgerwood cableway of 400 feet span installed on the center line of the street directly over the sewer.

The head tower of the cableway is a timber structure mounted on four wheels and is advanced when necessary on a temporary broad-gauge track laid for the purpose as required. The tail tower consists of a shear frame that is lowered to the ground and moved bodily to the new position and re-erected when the cableway is shifted. The anchorages for the main cable consist of three 12 x 12-inch horizontal transverse timbers 12 feet long, engaging 12-foot vertical timbers in a pit excavated in the middle of the street and backfilled.

Holes 1½ inches in diameter and about 12 inches apart are made in two longitudinal lines about 9½ feet each side of the center line of the sewer, by a jackhammer drill operated by compressed air, to limit the size of the sewer trench. The earth is excavated at the working face of the trench so as to undermine the concrete base of the asphalt pavement and the latter is broken off in large chunks by sledging and is removed in the 1-yard steel buckets operated by the cableway. Excavation under the pavement is made by pick and shovel, and the sandy soil is removed in the same way and dumped directly in motor trucks, operated by the Hagerty Company, that haul it about 5 miles to the spoil banks.

After the removal of the pavement the excavation is commenced on each side of the sewer with a trench about 18 inches wide and 2 feet deep to receive the sheet piling. Rectangular frames consisting of two 10 x 12-inch rangers about 16 feet long and two 10 x 10-inch transverse struts are fastened together with scabs and put in horizontal position on the surface of the ground, the rear ends of the rangers being spliced to the forward ends of the last rangers set in the sheeted part of the trench.



SEWER ARCH REBUILT IN OPEN TRENCH

The rangers are aligned in position by blocks wedging them 2 inches away from the asphalt pavement so as to leave clearance between it and the rangers to receive the 2 x 10-inch sheeting planks 18 feet long adzed to a knife edge at the bottom, that are set in position by men working on outside scaffolds about 7 feet high.

After a group of 10 or 15 sheet pile units have been thus assembled they are successively driven

a foot or two by a McKiernan-Terry steam hammer operated by compressed air, one hammer on each side of the trench working together and going back and forth from end to end of the group of sheet piles driving them a foot or two at a time as the excavation progresses until they are driven down full length.

After the sheeting is started in the shallow trenches on the surface of the excavation the dumpling is excavated between the trenches and the full width of the trench is excavated to a depth of about 15 or 16 feet, additional rangers and cross braces being set from 5 to 3 feet apart vertically as the excavation progresses.

When the excavation reaches within 2 or 3 feet of the bottom of the sheeting, a second tier of 10 x 2-inch sheet piles 16 feet long is started against the inner face of the lower rangers and driven like the other as the excavation progresses, eventually penetrating the full length and reaching down below the undisturbed old sewer.

When the old sewer arch is exposed it is carefully broken away in small pieces down to springing line, the debris falling on the wooden working platform which is built in advance about 3 feet above the center of the invert to permit the normal flow of the sewer underneath and to prevent any injuries or obstructions to the invert from the falling materials.

After the removal of the old arch and the preparation of the skewback surfaces and the side walls, wooden arch centers in sections about 20 feet long are supported from the invert, outside ribs are set, and the lower pieces of lagging are placed, reinforcement bars are assembled and wired in position, supported the proper distance above the arch forms by small concrete blocks, and the arch is concreted at the rate of one 20-foot section in about 4 hours, the weekly advance varying from 30 to 50 feet.

Concrete is mixed in one Foote and one Ransome two-bag machines moved along from time to time in the street adjacent to the excavation and supplied by wheelbarrows with stone, sand and cement delivered by trucks and stored in small piles on the surface of the street alongside the trench. The cement bags are placed on slightly elevated platforms and covered with tarpaulins to protect them from rain.

The work is executed between temporary timber bulkheads from 150 to 200 feet apart which are thoroughly braced to retain the sand from caving into the trench. At one end of the bulkhead section the excavation is progressing and the sand, shoveled into buckets, is being hoisted from the trench, transported by the cableway and dumped over the finished arch to backfill the trench by one continuous operation. The backfill is kept saturated with water from a hose to thoroughly compact it. The excess material not required for backfill is removed in Pierce-Arrow motor trucks. The Lidgerwood cableway hoists are operated by electricity, as are also the concrete mixers and the Sullivan air compressor.

The work, which was designed under the direction of Arthur J. Griffin, chief engineer of the Bureau of Sewers, Borough of Brooklyn, is being executed at a contract price of $485,000 by Booth & Flynn, Limited, under the direction of Morgan Bateman, superintendent. The average force employed is about 180 men, who receive from $5 to $7 per day. According to the terms of the contract the work is to be completed in 175 working days and is now being advanced at a rate equal to that of the required schedule.

Activated Sludge Experiments in England

Conducted at Stoke-on-Trent during past two years, dealing with waste water from potteries.

During the past two years experiments with the activated sludge system have been conducted at the Tunstall sewage works of the corporation of Stoke-on-Trent, England. The results are given in a report made by W. H. Makepeace, borough sewage engineer, the following abstract of which appears in "Municipal Engineering and the Sanitary Record," London:

The sewage of this district is heavily charged with trade waste from the potteries, known as "slip," and the particular object of the experiments was to ascertain whether such sewage could be successfully treated by the activated sludge process. The Tunstall works were selected because the sewage was organically stronger and contained a much larger percentage of trade wastes than at the other outfall works of the corporation.

The existing works were altered to adapt them to the activated sludge process and provided (a) a detritus tank 9 feet by 21 feet, having an average depth of 5 feet 6 inches and containing 6,700 gallons, (b) an aeration tank 75 feet by 42 feet 9 inches, with semi-circular ends and average depth of 7 feet 9 inches. Its capacity was 156,875 gallons, and the superficial water area 418 square yards, (c) a sedimentation tank 25 feet diameter and average depth of 13 feet 10½ inches, with capacity of 42,500 gallons, and having a downward flow inlet and sludge scraper. A duplicate tank, doubling the capacity, was, however, put into commission at a later date. The aerating tank was divided into ten bays by division walls with submerged portholes to permit the flow of the sewage through each bay in series. The floor of the inlet bay was formed on the ridge and furrow principle with diffusion plates across the full width of the bay at the bottom of each furrow. The other bays were divided lengthwise into

three sections by baffle boards with a row of diffusers on the upstream side of each; the floors had a slight fall between each baffle in the direction of the flow. The air was supplied by an Ingersoll-Rand compressor having a capacity of 203 cubic feet per minute when working at 10-pound pressure, but the air pressure used was 4 pounds.

Difficulty was at first experienced in getting the sludge built up to a satisfactory condition, and it was found that septic sludge was being formed at intervals throughout the aeration tank, particularly in front of each row of diffusers. There was also trouble in maintaining a regular and continuous supply of air, due partly to engine and compressor troubles. Investigation showed that some of the trouble was caused by an excess of "slip" in the aeration tank, and as this has a very high specific gravity—2.5—the air supply then available was not sufficient to keep it in circulation, and it settled in places to a depth of 3 feet. Many of the diffusers were found to be choked, and trouble was caused by short-circuiting through several small openings which had been left in the division walls at the time they were built in order to facilitate emptying when necessary. The amount of "slip" was reduced by passing the detritus tank effluent through an additional grit chamber; the holes in the division walls were blocked up, the diffusers cleaned and the compressor speed slightly increased.

From the time these alterations were completed the results steadily improved until the necessary quantity and right quality of sludge was built up. This occurred in July, 1919, and since that date a most satisfactory effluent has been consistently produced. During the first two months of these initial experiments the plant was worked on the continuous flow system, but subsequently the fill and draw method was adopted.

Information obtained from the experiments

After a satisfactory effluent had been obtained, the tanks were worked on the continuous flow method at the rate of 120,000 gallons per 24 hours, which was increased after a few weeks to the rate of 300,000 gallons per day and an effluent of consistent good quality was obtained. The remarkable feature of this was the high nitrate figure produced, and the thoroughly stable character of the effluent has always been satisfactory; the reduction of the bacteria content amounts to 98 per cent, and the dissolved oxygen test shows 0.33 parts per 100,000 compared with the Royal Commission limit of 2 parts. Careful observation was made of the sludge returned from the settlement tank to the re-aeration tank, and it was found, after three hours' settlement, to be 70 per cent of the total volume returned.

The average analysis of the activated sludge in parts per 100, or as a percentage, was: Mineral matter, 49.2; organic matter, 50.8; nitrogen, 4.5; grease, 2.75.

Experiments were made with percentages of sludge in the aeration tank varying from 25 to 45 to ascertain whether it was practicable to carry a reserve of activated sludge in a tank normally dealing with dry weather flow so as to provide the additional sludge necessary to comply with the Ministry of Health's requirements for treating the varying rate of flow of sewage, viz., from one to three times, in stand-by tanks. It was found that an excess quantity of sludge could be successfully maintained by a dry weather flow, and that if stand-by tanks were provided and mechanical means arranged for rapidly discharging the surplus sludge from the dry weather flow tanks, varying rates up to three times the dry weather flow can be successfully treated. Throughout the experiments the flow dealt with was not constant, but varied exactly in proportion to the flow from the sewers.

Good results were obtained with settlement tanks of half the capacity of the aerating tanks, but Mr. Makepeace is of opinion that they would have been better with pyramidical bottoms.

The activated sludge showed an increase of nitrogen content of 346 per cent over ordinary sludge, which brings its utilization for fertilizing purposes within the range of a commercial proposition. The most successful method of sludge treatment was found to be evaporation by utilizing waste heat from an oil engine exhaust pipe.

The plant has intentionally been satisfactorily subjected to all sorts of abuse which it would be likely to meet in everyday practice. It was found that sewage could be run through the tanks for three or four hours while the air supply was discontinued, without serious effect on the effluent. Again, the compressor and the inflowing sewage was stopped for periods of from three to ten hours in twenty-four, and the efficiency was unimpaired when the flow was re-started.

The quantity of air was varied from 1.108 to .624 cubic feet per gallon, without any effect except to reduce the velocity through the aeration tank from about 2.5 feet per second to 1.5 feet. Below this rate settlement on the bottom commenced.

Conclusions drawn from experiments

As a result of the experiments, Mr. Makepeace considers that the system is reliable when once established, and is not likely to be interfered with by the trade wastes of the potteries. The system is considerably less costly to construct than ordinary bacterial methods, and its maintenance would be less than that of their existing plants. It can often be applied without a pumping scheme. The works can be controlled by a much smaller but more skilled staff. There is no aerial nuisance under the worst conditions, while the resultant sludge is inoffensive and possesses higher fertilizing value than the sludge from existing plants. An area of bacterial beds should be constructed or suitable land provided for use in case of a possible breakdown of the activated sludge plants.

Mr. Makepeace estimates that a complete plant, partly bacterial and partly activated sludge, for a population of 50,000 with a dry weather flow of 1½ million gallons would cost £85,000 as against

£125,000 for a plant on present-day bacterial lines. This includes for dealing in times of storm with three times the dry weather flow as sewage and three to six times as storm water. The maintenance charges (excluding capital charges) are estimated at £4,372 compared with £6,800 for a plant wholly bacterial.

The scheme Mr. Makepeace recommends for a new installation are: Three detritus tanks, total capacity 1/25 dry weather flow; two sedimentation tanks, total capacity 1/3 dry weather flow; two aeration tanks (sub-divided), total capacity 2/3 dry weather flow; two settlement tanks (pyramidical bottoms), total capacity 1/3 dry weather flow; bacteria beds of cubic capacity equal to 1/3 dry weather flow on basis of 70 gallons per cubic yard; two sludge storage tanks for dewatering sludge from settlement tanks before drying, total capacity 1-130 dry weather flow; and sludge beds based on 1 square yard per sixteen persons.

Water Supply of Bluefield

The chief engineer of the State Department of Health of West Virginia, E. S. Tisdale, has recently made a report upon the water supply of Bluefield, W. Va., after an investigation which had been requested by the Chamber of Commerce of that city.

The report describes the present sources of supply and comments upon their quality and quantity. There are three sources of supply, one a gravity flow from eleven springs on East River mountain which furnishes approximately 250,000 gallons a day; second, springs located at the lower end of the valley below East River mountain, about two miles from the city; and third, springs about four miles from the city on the east side of the same mountain. The third source is relied upon to furnish the main portion of the supply.

The valley in which the second source is located is a typical limestone formation filled with sink-holes, the springs being in reality the outflow of an underground stream flowing through the cavernous formation in the limestone. The water is apparently derived from both underground sources and surface drainage through sink-holes. At time of rains, muddy water appears at the springs as proof of the surface source of much of the supply. Some twelve or fifteen houses have cesspools, the contents of which finds its way into these sink-holes and thence probably to the underground stream and springs. The danger of this condition has caused the city to treat the water with chlorine, which is probably to be given credit for the failure of typhoid to make its appearance in the city. These springs furnish approximately 500,000 gallons of water a day.

The third source of supply is in reality similar to the second, being springs fed by an underground stream running in limestone caverns and fed by surface water. It is not known that there is any pollution of the underground streams forming this third source of supply, but on the other hand, it is not certain that there is not some such pollution. These supplies are treated with liquid chlorine continuously and with conscientious care and duplicate machinery for emergency purposes is maintained at each station. Water is treated at the rate of approximately 0.2 parts per million. Bacteriological analyses of the water are made monthly by the State Department of Health. Records of typhoid cases in the city for the past two years show that there had been one, two and, in two instances, three cases per month.

Mr. Tisdale recommends that all of the residences on the water-shed draining to these sink-holes be compelled to connect up to the city sewerage system or to install tight septic tanks or similar contrivances.

In addition to the objectionable feature of the quality of the water, there is grave possibility of a shortage of the supply from these springs, owing to the very rapid growth of the city. All of the water from the springs is being used to capacity and, as 90 per cent of the services are metered, it does not seem possible to diminish the consumption. He, therefore, recommends that the city not only take immediate steps to prevent the pollution of the underground supply, but that it employ an engineer to plan for increasing the volume of supply.

Citizens Oppose Municipal Water Ownership

A rather unusual condition of affairs exists in Sacramento, where the recently annexed district of Oak Park is insisting that it continue to be served by the Oak Park Water Co. rather than by the municipal water department. It seems that the water furnished by the local company is considered to be of a quality superior to that furnished by the Sacramento Water Department, and the citizens of the Oak Park district believe that the water which had been served them prior to annexation is the biggest business asset of the district. The Merchants' Club and other organizations and mass meetings have protested to the city against the contemplated purchase of the Oak Park Water Co. distribution system and the furnishing through it of water from the municipal supply. Citizens of the district claim that at the time of annexation there was an agreement made with the city of Sacramento that they would continue to receive the Oak Park water and some have even expressed their desire of again separating Oak Park from the city government of Sacramento if the city insists upon discontinuing the present supply.

No More Convict Labor on New Jersey Highways

It has been reported that the State Highway Commission of New Jersey has decided to discontinue using two road camps used by convicts who were employed in building the state highways, this action being the result of a recommendation of State Highway Engineer Wasser that convict labor on the state highways be abolished.

Asphalt Production, Refining and Storing

By HERBERT SPENCER*

Production in the Mexican field, transportation to this country, refining, storing and transporting the refined product, are described briefly. The author makes a plea for agreement on a few standard penetrations.

Practically everyone is familiar with the process required to quarry and crush stone, and most of the other materials used in the construction of pavements in general. However, little has been written on the production and refining of asphalt cement used in paving work, and the object of this paper is to describe briefly some of the features entering into the production, transportation and refining of the oil from which asphalt is made, together with some of the problems incidental to the shipping of the finished product and the handling at the asphalt plant.

As the Mexican asphalt has been extensively used in all classes of paving work throughout the eastern part of the United States, the remarks will be confined largely to this grade, although applicable to most asphalts used in paving work.

The quantity of asphalt produced from domestic oil, Mexican oil and imported Trinidad and Bermudez asphalt and in use in the United States for various purposes is shown by accompanying table:

RODUCTION AND TRANSPORTATION

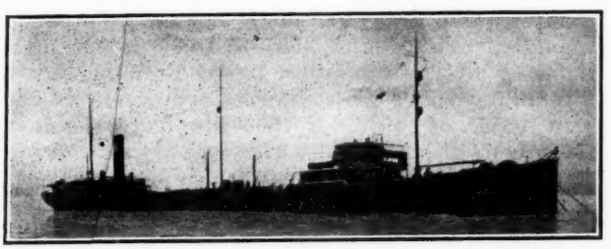
Before the introduction of petroleum asphalt in the United States, dependence of supply was based largey upon the imported native asphalts from Trinidad and Bermudez. It is evident, however, that since the introduction of asphalts from domestic and Mexican petroleum, the demand for the native asphalts has steadily decreased. Continuation of supply from Mexican fields will largely influence the completion of the large road and street-building program upon which we are now embarked, and although conditions in Mexico are far from being settled, the field is still in operation and apparently has not been seriously affected by the large quantities of oil drawn from it since it was first opened. In some sections of the Mexican oil district, and particularly in northern Vera Cruz, disturbing infiltration of salt water has affected a horizonal plane extending over a wide area, rendering unfit for use part of the oil produced. This has meant the extinction of many of the large producing wells; but prospecting in adjacent fields indicates a steady increase in the production of the Mexican oil.

The main factors entering into the use of Mexican oil, based upon present conditions in Mexico are: (1) Price, (2) Pipe line facilities, and (3) Transportation.

The Mexican government, by its new constitution, has interpreted Article 27 to provide in a retroactive manner for nationalization of all oil lands. The export tax on the Mexican oil is so heavy that a considerable part of the value of the crude at the well is collected as taxes by the Mexican government. The construction of pipe lines from the fields to the Gulf of Mexico has facilitated the movement of the crude, and increased facilities in the way of pipe lines will materially add to the quantity which can be made available for transportation to the refineries in the United States. At the close of the war the number of tank steamers available for service in bringing Mexican oil to this country was limited. Tankers now in course of construction will be placed in this service as rapidly as possible and it is expected that this will aid in materially increasing the quantity of crude oil carried from Mexico to the United States and its reduction into asphalt for commercial use.

TONS OF ASPHALT FROM VARIOUS SOURCES

	1914	1915	1916	1917	1918	1919
Domestic	360,000	665,000	690,000	702,000	530,000	600,000
Mexican	316,000	390,000	533,000	644,000	652,000	672,000
Trinidad	78,000	133,000	132,000	132,000	65,000	.....
Bermudez	50,000	33,000	48,000	52,000	48,000	.....



AN OIL TANKER LOADING OFF SHORE

Pipe lines from the wells are extended out to sea; the tank steamer picks up the buoyed end, the oil is turned on, the pressure at the well being sufficient to force the oil into the tanker.

*C. E., Standard Oil Co. of N. J., New York City.

Tankers vary in size from 60,000 barrels to 115,000 barrels capacity and make the trip from Mexico to Atlantic ports in about eight days. They are all equipped with powerful pumps, and require about forty-eight hours to load and the same time to unload. Connections are generally 8-inch suction and 10-inch discharge. In some cases the oil from the well is loaded direct to the tanker, the pressure at the well being sufficient to force the oil through the pipe lines and into the steamer. This has resulted at times in too rapid loading, as difficulty has been experienced in properly controlling the flow.

REFINING

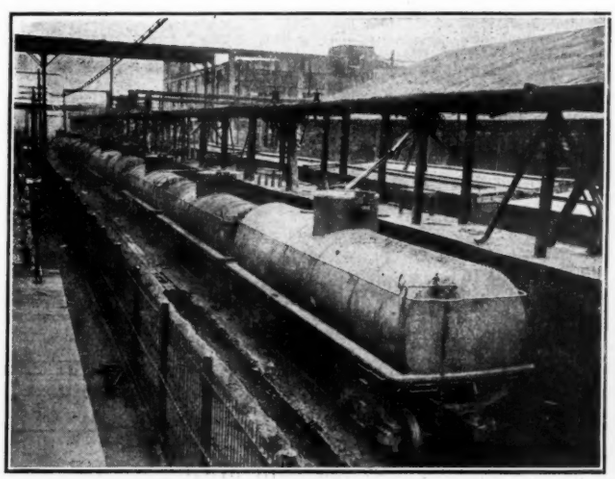
When the oil reaches the refinery, it is unloaded into storage tanks, and from there is charged to the stills, which are generally in batteries. The oil is reduced at a temperature of about 600 degrees Fahrenheit. This operation takes about sixty hours, and necessitates maintaining the correct temperature until the material reaches the penetration desired. Overheating or too rapid distillation would probably result in affecting some of the essential characteristics of an asphalt cement, such as ductility, susceptibility to climatic changes, and other features. Careful tests for penetration indicate when the material has reached the correct degree of hardness, and as the stillmen become proficient after handling large quantities of material, mistakes seldom occur. Retained samples of all material are kept for reference, and if any discrepancies in tests are reported, a comparison with the retained sample is made to determine what, if any, change has taken place since the asphalt left the refinery. Only accepted standards for testing are followed, those in common use being methods adopted by the American Society for Testing Materials, American Society of Civil Engineers, and similarly constituted bodies.

It might be well here to point out some of the difficulties that confront the refiner due to the great divergence in specifications, and particularly in reference to the variety of penetrations called for. Wallace L. Caldwell, of the Pittsburgh Testing Laboratory, estimates the causes of failure of asphalt wearing surfaces as follows:

Unsuitable mineral aggregate	30%
Improper manipulation at mixing plant	25%
Poor workmanship on street	15%
Bad weather conditions	15%
Bitumen of improper consistency	10%
Bitumen unsuitable for paving	5%
	100%

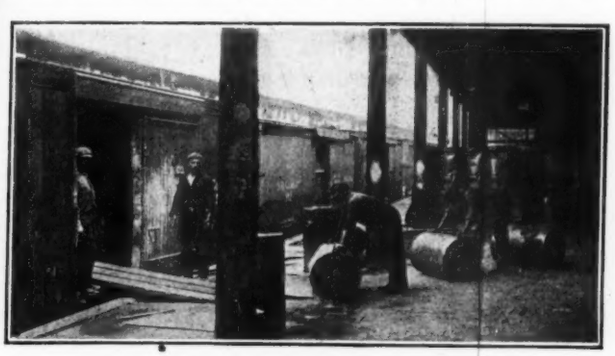
The larger cities generally lay a heavy-traffic mix and a light-traffic mix, each of which requires an asphalt of different penetration. In addition to this, an asphalt for bituminous concrete is in great demand. These three grades constitute the bulk of material for the heavier forms of asphalt construction, and no hardship is imposed on the refiner to meet these requirements. The penetrations most commonly used are 35-45 penetration, 45-55 penetration and 55-65 penetration. However, when sub-divisions of these grades are called for, it necessitates additional storage and materially affects the running of regular grades. At present refiners are asked to make asphalt of 35-40 penetration, 40-45, 45-50, 50-55, 55-60, 60-65, and 65-70, and in some cases request is made to run a material to definite penetration. The discrepancies in the test for penetration as made by different operators leave much to be desired in the practical making of this test and unnecessary grades inflict a hardship on the refiner in keeping so many stocks, when probably not more than three grades would be sufficient to meet all the variations in hardness required in an asphalt cement. The committee on asphalt of the A. S. M. I. should study this matter, and this committee, in conjunction with the Technical Advisory Committee of the Asphalt Association, should determine the penetrations best suited for the different kinds of asphalt pavement, specifying these penetrations with allowable limits instead of leaving it optional with the engineer to order any penetration he thinks best suited to his work.

After the asphalt has been reduced to the proper consistency it is pumped either to tank cars or to storage tanks. Tank cars are loaded from an overhead rack, and barrels or drums filled from storage tanks. The tank cars in use are from 6,500 to 10,000 gallons capacity, and are equipped with steam coils capable of heating the material



LOADING RACK FOR TANK CARS

Tank cars are first inspected to see that coils do not leak, and that all fittings are in place. Cars are filled to maximum capacity.



LOADING PLATFORM FOR PACKAGE SHIPMENTS

Packages are first weighed and then stenciled with the grade of asphalt, weight and date.

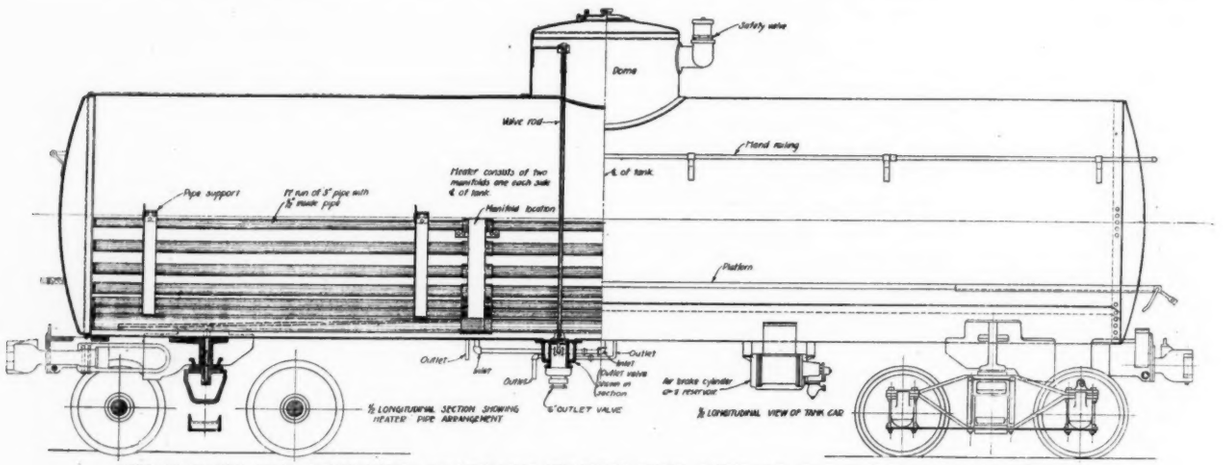
so it can be pumped in from six to ten hours. Drums are first coated with a lining of clay or similar material to keep the asphalt from sticking, and are then filled from hand nozzles. Each drum is weighed before loading, stamped with the name of the material and such other identification marks as may be necessary, and then rolled into cars for shipment.

CONTAINERS

Intimately bearing upon the economy of asphalt work is the question of containers used for shipping and storing the asphalt. This material, flowing readily on the application of heat, makes it possible to handle in bulk, thus obviating the necessity of handling in packages. When shipments of Mexican asphalt from the Atlantic and Gulf ports became heavy in 1912 and 1913 it was necessary to arrange for the transportation of this material in bulk from the refinery to destination. Fortunately the tank car had been handling asphalts for purposes other than paving for many years and required nothing new to enable it to handle the paving asphalt cements. The tank cars are equipped with steam coils, and require a minimum of fifty pounds of steam to heat sufficiently to enable them to be unloaded in from ten to twelve hours.

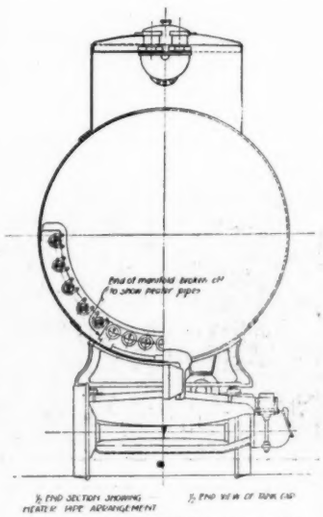
countered. The Mexican asphalt supply depends upon the Mexican oil supply. Delivery to the refineries depends upon ocean transportation. Delivery to the consumer depends upon railroad conditions and a mobile tank-car service. Shortage or delay in equipment, strikes or embargoes in transportation affect the delivery of material to the consumer, and the present unsettled condition of all markets has caused delays unknown under normal conditions.

(To Be Continued)



UNION TANK CAR COMPANY'S STANDARD HEATER PIPE ASPHALT CAR WITH 1,000-GALLON TANK.

Due to causes entirely beyond the refiner's control, he is at times confronted with conditions that make shipments uncertain, and when a combination of adverse conditions occurs, and especially during a season when demand is far in excess of supply, it is but natural that delays should be en-



CROSS-SECTION OF CAR

Some Municipal Statistics

According to the figures given in advance sheets from Crain's Directory, there are 60 cities in the United States of over 100,000 population, 60 between 50,000 and 100,000, 131 between 25,000 and 50,000, 445 between 10,000 and 25,000, 548 between 5,000 and 10,000, 844 between 3,000 and 5,000, 1,043 between 2,000 and 3,000, and 2,921 between 1,000 and 2,000. The counties in the states total 2,800.

Of the 5,359 waterworks systems in the country, 1,488 are privately owned and 41 are of mixed ownership. Of the total number, 1,066 are operated in conjunction with lighting plants. The total horsepower of waterworks pumping machinery is 1,021,482, of which 852,646 are steam, 103,216 are electric and 65,620 are internal combustion and water power.

Lumber Reports

The weekly trade barometer of the Southern Pine Association, New Orleans, reports that for the week ended November 26 orders for lumber received aggregated 41,978,402 feet and shipments, 55,716,391. These figures embraced 136 mills and showed shipments 1.87 per cent greater than the week's production and orders 23.25 per cent less than the week's production, the production itself being 38.84 per cent below capacity.

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A. PRESCOTT FOLWELL, Editor
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CONTENTS

A Government Monopoly of Power

The cities of the entire province of Ontario, Canada, are in the grip of a monopoly so far as electric power is concerned, only one city in the province, it is reported, being able to obtain current from any other source. But the monopoly is an unusual one, being a commission created by the province itself. Perhaps the nearest parallel to it in this country is the Metropolitan Water Commission of Massachusetts (in its form as originally created), which developed or acquired and sold the water supplies used by Boston and its suburbs.

But the Canadian Commission is far more comprehensive and extensive in its scope and territory than the Massachusetts commission. It has bought up eighty-four private distributing companies besides all of the companies generating power on the Canadian side of Niagara Falls, having just paid about thirty-two million dollars for its last and largest competitor. For thirteen years it has fought private competition and capital and is now victor. It generates and distributes practically all the power used north of the Great Lakes, selling current to the cities at approximately cost of delivery. Besides the generating and transmission system, it owns electric railways, operates testing and research laboratories, farms land on its rights of way, and furnishes engineering advice and assistance to municipalities relative to electric lighting and other uses of power.

There are many interesting features connected with the operation of this commission, financial, administrative and engineering. Its assets approximate seventy-five million dollars. It sells current at cost, keeping a separate account with each city of the cost of generating the current it receives, of transmitting it to the city and its share of administration expense; these costs vary from $12 to $70 per horsepower. It constructs as well as operates power plants and transmission lines over probably 50,000 square miles of territory.

A public enterprise in the United States proportionately large would be, for example, government operation of all the coal mines of the country. If this should come, let us hope that it will be conducted to as full advantage to the public as is the public ownership of hydro-electric power in Ontario.

Encouraging Labor Signs

The return of the pendulum and the ultimate equilibrium of supply and demand are never to be seriously questioned, but sometimes they are discouragingly slow.

The war prices and reconstruction period through which we have passed have afforded opportunity for predatory crimes from which no class has been free, but the strongest possible encouragement is now afforded by the signs on every hand that the crest of the wave is well past and that affairs will hasten more and more rapidly towards normal, even passing it for a long and solid era of increasing prosperity. This is true with commerce and finance, industry and production, capital and labor, and even with politics and religion.

Production and consumption are becoming more normal, profiteering in all quarters is being reduced, or punished, or threatened, and the interrupted tide of prosperous activities is rapidly gaining momentum. It will adjust itself automatically in construction matters by greatly increased public operations using the thousands of millions of dollars already available and the increasing amount of materials and transportation for the double purpose of catching up with vital improvements and for affording employment to the idle and stimulating business, at the same time that the unsettled conditions and uncertain mar-

kets delay the resumption of private and corporation work that will later revive in enormous and sustained quantities.

This adjustment has already commenced and will safely bridge the period between the great difficulties that we have passed and great opportunities that we are rapidly approaching. One of the most important indications is the changing attitude of labor. Although the rank and file do not yet, and perhaps never will, understand the reasons, they are beginning to feel that piling strike on strike, increase of pay on increase of pay, shortening the hours, reducing production and interfering with the comfort and safety of the nation has not brought them any permanent advantage. They are dissatisfied with radicals, extravagance and unrest, for they have suffered from the unnecessarily high cost of living and begin to realize that unlimited employment will not be given them when their wages are too outrageous or their actions too unreasonable. Capital may be forced to pay high wages but not to give full employment. Unjust strikes and sabotage do not receive public sympathy, and instead of demanding them, labor is rapidly turning its attention to holding a job, to giving better satisfaction, increasing production and in some cases willingly accepting smaller pay rather than none at all.

The radical element is discredited and the latest reports from labor executives indicate an encouraging change of heart in the abeyance of "direct methods" and the adoption of the more powerful and manly policy of democratic methods to secure reforms or privileges by legislative methods.

This is a long step in the right direction and there is little fear that any very undesirable legislation will result or that such legislation would be at all permanent if secured. This brings it into the public educational field which, above all things, is to be desired for the general good.

It has been announced that the program of the Executive Council of Organized Labor for the coming year includes strenuous efforts to secure the repeal of existing laws and to prevent the enactment of proposed laws requiring compulsory arbitration of industrial disputes; opposition to laws restricting the right of workers to quit work, otherwise to strike; legislation for immigration restriction so drastic as to practically prohibit immigration; and Americanization of aliens.

One of the most encouraging features of this platform is the plank for the Americanization of aliens, in which all classes could and should heartily join.

To Save High Bridge

The recommendation of Grover A. Whalen, commissioner of plants and structures of New York City, that High Bridge be removed has called forth protest from a number of sources, including practically all of the engineering bodies of the district. One of the latest of these to enter protest is the New York chapter of the American Association of Engineers. In its letter of protest it says that "High Bridge is not only a structure of esthetic value and a memorial of an important engineering project, namely, the bringing to New York of the first supply of water adequate for a metropolitan city, but also is of utility as a highway and of still further use as an aqueduct in case of emergency." It declares that an expenditure of $750,000 for necessary repairs to the bridge, the amount named by Commissioner Whalen, would be justified. Hearings on this question by the Board of Estimate have been adjourned to January 3.

George S. Rice

George S. Rice, for seven years chief engineer of the Rapid Transit Board of New York, died December 7 at his home in Montclair, N. J., after an illness of several months.

Mr. Rice served recently as division engineer of the Public Service Commission. Original studies of the New York subway project were made by him between 1892 and 1900. In 1904 he became chief engineer of the New York Rapid Transit Commission, remaining in that position under its successor, the Rapid Transit Board.

He was born in Boston in 1849, and was graduated from the engineering department of Harvard in 1870.

Maintaining Distribution System in St. Louis

In the St. Louis waterworks there were, at the end of the latest fiscal year, 12,877 stop valves and 11,944 fire hydrants. Each fire hydrant was cleaned, oiled and packed in place an average of nearly three times, or 34,245 in all. Cleaning, oiling and packing of stop valves was performed 26,557 times, or more than twice for each valve.

The total amount of pipe in service was 1,013.4 miles, of which 611.3 miles was 6-inch and the next largest amount was 12-inch. There were only 2.4 miles of 4-inch, and 15.8 miles of 3-inch. On this system there were discovered during the year 1,057 leaks, of which 34 were breaks, 60 broken fire hydrants, 351 leaking fire hydrants, 209 leaking sprinkling hydrants, 30 leaking sleeves, 181 blown joints, 133 leaking taps and ferrules and 59 leaking valves.

During the year the city continued the cleaning of water mains of all sizes from 6-inch to 20-inch, inclusive. About 60 miles of mains were cleaned and there was removed from them 568.67 tons of incrustation, or 16,605 cubic feet. The amount of incrustation per lineal foot of pipe varied from 1.1 pound up to 6.75 pounds, the latter being in a 10-inch pipe. This work was done by the National Water Main Cleaning Co., which has completed a contract for cleaning 92 miles of the city's mains. The average age of the mains cleaned was 29 years. The average efficiency before cleaning was 49 per cent, based on Pitometer tests, and the average efficiency immediately after cleaning was 95 per cent. The efficiency is found to fall off to some extent after cleaning, due, as nearly as can be determined at present, to the scratching of the interior coating and the subsequent rust formed on these scratches. Data

on the rate of deterioration are being gathered by monthly tests on several representative lines and by random tests of lines cleaned on previous contracts.

Public Work for Unemployed

At a meeting in Jackson, Mich., December 9, of managers', manufacturers' and employers' associations of a dozen industrial cities of the state resolutions were adopted calling upon the governor and mayors to at once start work on contemplated public improvements in an effort to furnish relief, instead of awaiting anticipated reductions in material costs.

The conferees estimated that $150,000,000 was now available for such work. It was shown that of a total of 495,000 men normally employed 312,000 are now at work. The cities represented included Detroit, Battle Creek, Jackson, Saginaw, Muskegon, Flint, Pontiac, Kalamazoo, Lansing and Grand Rapids.

Delaware State Highway Testing Department

Well equipped laboratory at headquarters for continual testing of materials and of concrete specimens made there and in the field. Research work and experimental investigations also conducted there.

The small size of Delaware allows the control of the quality of materials from a central point, which is located at Dover, and this eliminates many of the usual field tests.

The laboratory of the Division of Tests and Investigations occupies the basement of the State Armory, in which the State Highway Department offices are located. It includes all the equipment necessary for making routine and check tests of road materials, including asphalts, tars, sand, stone, cement, etc., and is equipped to carry on certain kinds of research work. All tests are made in accordance with the standards of the American Society for Testing Materials.

All cement is sampled at the mill prior to shipment, the tests being made at this time in order that no work will be held up due to untested cement not being allowed for use. Samples of cement are also taken periodically from cars received, and tested in order to check the results obtained in the cement district.

All sand is tested at stated periods. Local sand pits are sampled daily in order that any nonuniformity may be determined. Sources of supply which have been operated for some time and have shown a uniform quality are generally not tested more than twice weekly unless a question arises.

All stone is tested at stated intervals, depending upon the source of supply. Due to the fact that this state receives its stone supply (crushed trap rock) from permanent quarries, very little trouble is encountered in securing stone above the requirements.

All asphalts and tars are tested at Dover, samples being taken of each shipment and forwarded to the laboratory.

In addition to the cement, sand, stone and water being tested separately for all concrete road work, the inspector on each contract makes two test specimens each day from the concrete being laid.

One of the specimens is a 6 x 12-inch cylinder, used for compression tests, and the other is an 8 x 8 x 5-inch block used for making wear tests by means of the Talbot-Jones rattler, which has been added recently to the laboratory equipment.

These road test specimens are cured under the same conditions as the roadway and removed to the laboratory for test. The test results are compared with laboratory specimens, made from the same materials used on each of the different contracts as standard. This program furnishes a check on all phases of the work and assists in locating any trouble occuring which would be detected from low strength tests of the road specimens.

In order to follow the uniformity and to compare the quality of all materials used in concrete road construction, sample boxes are sent to each contract to be filled and returned to the laboratory upon the first day of each month. These 12 x 12 x 12-inch boxes are divided into compartments in which are placed the samples of sand, stone, cement and water being used at that time.

The sample box is arranged so that no inconvenience is experienced in packing the samples, as bags are included in the box for sand and cement and a bottle is furnished for the water sample. This box is secured with a padlock and sent to the laboratory.

LABORATORY EQUIPMENT

For asphalt testing the New York Testing Laboratory penetrometer, the Smith ductility and the Dulin Rotarex are among the larger pieces of apparatus used.

The Tyler standard sieves are used with the Tyler Ro-tap machine for routine sieve tests.

For stone the Deval abrasion machine is used and the strength of the concrete is tested by means of a 100,000-pound Olsen Universal testing machine.

The Standard brick rattler is used for making brick tests and the Talbot-Jones rattler for making wear tests on concrete specimens.

In addition to this equipment, a flow test table has been installed for experimental purposes. This table is used in conjunction with the slump test for determining the consistency of concrete mixtures. It was originated by G. M. Williams of the Bureau of Standards and he has been very successful in his results with it. It consists of a flat-top table and a cam arrangement so that a freshly molded specimen of concrete may be

placed upon it and alternately raised and dropped, thereby being subjected to a bumping effect to cause the concrete to flow out from the center of the table. The flow is determined by measuring the perimeter of the mass after being given a certain number of jolts at a given amount of drop.

When material is received for experimental purposes it is dried in large bins and then stored in other bins until used. All specimens are hand mixed upon a mixing board 4 feet square, lined with galvanized iron, sloped towards the center in order to prevent any water being lost. After removing the molds, the specimens are stored in curing pits where the cylinders are buried in sand which is kept damp for a period depending upon the nature of the test. In capping the cylinders, a layer of neat cement paste is finished on the top and bottom of each specimen. They are then placed in the testing machine with a piece of beaver board on each end, and broken. In case a road specimen comes in with a very rough surface, it is smoothed by means of emery on a flat steel plate before being capped.

Research is conducted in the laboratory which is mostly related to the problems encountered in the work as done under conditions in Delaware, although quite a little experimenting has been done with hydrated lime in concrete, the movement of concrete slabs, concrete hardeners, and other subjects of interest and value to the state. The advantages of a sand-cement mixture in replacing the 1-2-4 concrete used at present in this state are about to be determined, in hopes that a suitable wearing course may be obtained at a cost less than the present prices.

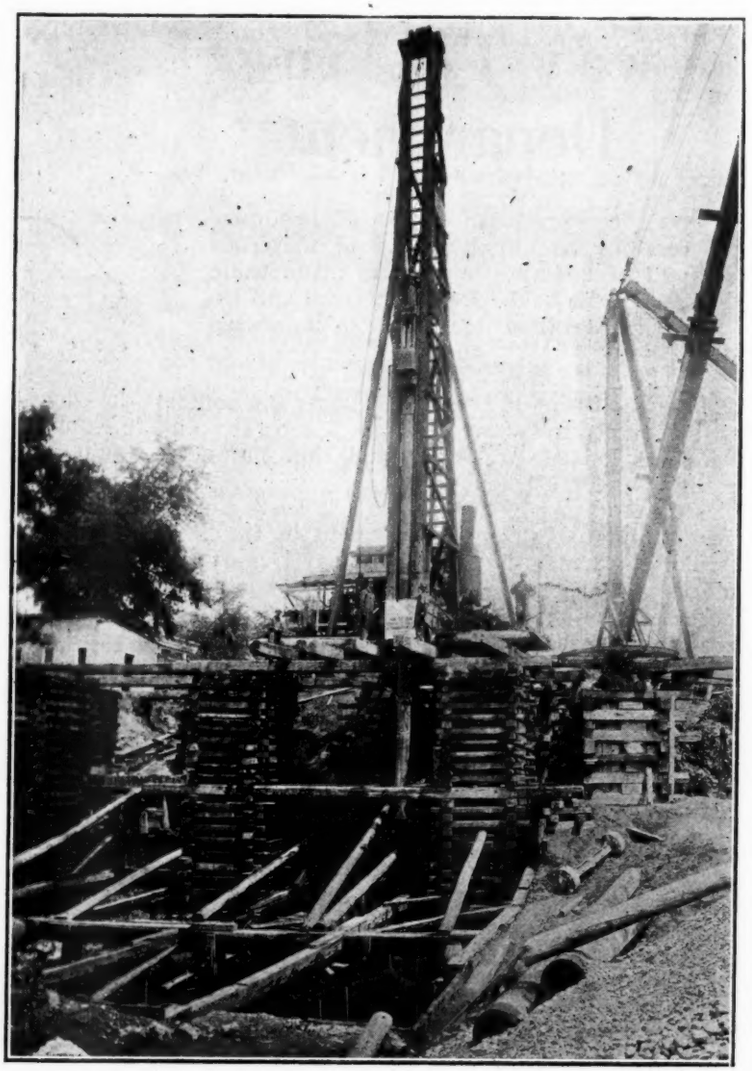
It is estimated that in 1921 automobile licenses in Minnesota will yield $5,400,000 to be spent for the building of good roads and apportioned to counties in proportion to the direct sum derived from licenses in each county. In addition it is expected that more than $300,000 will be derived from the dealers' licenses, chauffeur's licenses and other special fees.

Tate county, Mississippi, has suspended any further road improvements because of lack of funds. Last fall the county sold $300,000 of road bonds, with the understanding that the State Highway Commission would add $150,000. This offer was withdrawn later, and the county did not get the expected assistance from the state.

Pile Foundation for Bridge Approaches

40-ton equipment installed on cribbing 30 feet high, and on top of cofferdam at Western Gateway bridge over Mohawk river.

The great Western Gateway bridge between Schenectady and Scotia, N. Y., crosses the Mohawk river where the ground is soft and the heavy approaches are carried on concrete pedestal pile foundations. The general contracts were awarded to Dubois, Bennett & Son of Schenectady, who let the contract for the concrete piles for the abutments and approaches to the MacArthur Concrete Pile and Foundation Company, New York, who drove 706 patent pedestal concrete piles 16 inches



40-TON PILE DRIVER EQUIPMENT OPERATED ON CRIBWORK 30 FEET HIGH

in diameter and with an average length of 23 feet with their regular 40-ton equipment consisting of a wooden tower 60 feet high, a number one Vulcan steam hammer, a standard steel mandril and casing 42 feet long, and a 2-drum, 2-spool Lidgerwood hoisting engine operated by a 40-h. p. steam boiler.

WORKING IN DEEP COFFERDAM AND SHIFTING PLANT

On the Schenectady side, the general contractor built a 45 x 60-foot cofferdam for the abutment, extending close to the foot of the river bank 30 feet high. In this cofferdam with the bottom 10 feet below water level, there were driven 50 23-foot foundation piles installed from the top of the cofferdam 15 feet above the ground level.

After completing this part of the driving, the equipment was transferred to the top of the bank at an elevation 25 feet higher, or about 30 feet above water level. As derricks were not available for lifting the plant, it was lowered to skids at the foot of the bank, and the boiler was detached and hauled to the top, where it was immediately put in service and supplied steam to the hoisting engine that in turn pulled the remainder of the equipment up the inclined skids to the top of the bank, where it was assembled, the tower raised, and pile driving resumed.

It was at first expected that the main abutment would be concreted and ready to support the pile driver for the installation of piles close to the cofferdam at the foot of the bank. This, however, was not the case, and eventually the tops of some of the concrete piles already driven in the cofferdam were cut square and on them was built timber cribbing 30 feet high, surmounted by tracks on which the pile-driver was operated with such care that the work was rapidly accomplished without accident of any kind.

COMPENSATED SETTLEMENT

After the completion of the work on the Schenectady side of the river, the equipment was dismantled, transported to the Scotia side on trucks, installed over the cofferdam and operated there at a uniform level for the entire work. The ground was too soft to support the equipment, and in order to compensate for the settlement, jackscrews were placed between the cribbing and the main caps on which the runs were laid, and men constantly operating them maintained the pile-driver at the required height during the whole operation.

The work was executed by an average force of 22 men under the direction of E. M. Mahoney, field superintendent, while the entire job was under the personal supervision of F. L. Jenkins, general superintendent. The best record made was 23 piles 23 feet long in one eight-hour shift.

The cribbing in the cofferdam on the Schenectady side of the river consisted of independent cribs about 6 feet square, made with railroad ties and located in alternate pockets between the heavy cross braces in the cofferdam. The slender, tall crib towers were made very much stiffer by building into them, about halfway between the top and bottom, a course of 8 x 8-inch timbers 30 feet long, that passed through a pair of cribs and, when held in place by the heavy weight above, braced them firmly together.

Heavy wooden stringers laid on the tops of the cribs supported a set of five cross timbers on which three long transverse rollers were operated to move the pile-driver back and forth while it was adjusted transversely in the usual manner by pushing it along on the rollers.

In constructing this foundation, the concrete was subjected to the heavy impact required in the formation of the pedestals at the feet of the piles, and the displacement of the adjacent soil, as well as to the final continued static pressure produced by pushing directly against the top of the pile shaft and developing reaction corresponding to the great friction caused by withdrawing the temporary pile casing.

This treatment is obviously beneficial to the fresh concrete and results in an increased density and strength that is disclosed by the results of comparative tests of specimens of concrete taken from the completed sub-structure and superstructure.

These tests were impartially made under the strict supervision and rigid requirements of the state engineer's office and their average shows that the pile concrete was more than 21 per cent stronger than the superstructure concrete of the same proportions and specifications, even though the latter was slightly older when tested and had the advantage of being placed in an accessible position favorable for inspection and careful treatment.

COMPARATIVE TESTS OF PILE AND WALL CONCRETE

Testing Laboratory, State Engineer's Department,
Albany, N. Y.

August 18, 1920.

Mr. E. D. Hendricks, Division Engineer,
Albany, N. Y.

Dear Sir:

The following are the results of compression tests made on four 6 x 12-inch cylinders made of concrete taken from work on the contract for abutments of the Schenectady-Scotia bridge.

These cylinders were received at the laboratory on August 17 and were tested on August 18.

Cyl. No.	Date Made	Taken from	Age at test	Total lbs.	Compressive strength Per Sq. inch lbs.
*3	June 25	5th Sec. No. Wall	54 days	51,000	1810
*4	" 25	" "	54 "	50,500	1800
‡5	" 28	Pile No. 27	51 "	66,500	2350
‡6	" 28	Pile No. 27	51 "	57,000	2020

I would call attention to the differences in strength between the concrete in the piles and in the walls. We know that the concrete in the piles is mixed drier than that in the walls and the results secured indicate a better concrete.

Very truly yours,
RUSSELL S. GREENMAN,
Sen. Asst. Engineer in Charge of Tests.

*Concrete. 1:2½:5. Mix, placed by DuBois Bennett & Son.
‡Concrete. 1:2½:5. Mix, placed by MacArthur, C. P. & F. Co.

The abolition of the Department of Interior and creation of two new departments, one of public works and one of public welfare, will be proposed in a bill prepared by Senator McCormick of Illinois, which will also abolish the Board of Mediation and transfer its functions to the Department of Labor.

Immigration Notes

In spite of the fact that the transportation charges for immigrants have been raised from about $15 to $120, the number of Europeans flocking to this country is increasing with unexpected rapidity and conservatives view with apprehension the possibilities of an unprecedented inundation that, while it brings many sorely needed workers is also badly infested with defectives, undesirables, criminals and paupers, besides the vicious radical element whose purpose is treasonable.

Incoming vessels are more and more crowded and the estimates of unrestricted immigration within the last few years have risen from 5 to 10 and 15 millions and even to 25 millions, which are doubtless impossible but still indicate the magnitude and direction of the tide.

Strong efforts are being made to secure legislation to restrict immigration, some bills calling for universal exclusion and some keeping to limited numbers or classes, or restricted to a definite time, or to make the entrance requirements so difficult as to exclude a great proportion of the applicants. Suitable entrance requirements, calculated to encourage honest, thrifty workers and make them all loyal citizens in combination with rigid physical, mental and political inspection should be provided.

It is pointed out that, as the present special war-time passport regulations automatically expire March 4, immigration will then become much more unrestricted and it is necessary that emergency laws be passed in the meantime. Several bills have been prepared or are in preparation to present to Congress and it is probable that prompt action will be taken on them.

The American Federation of Labor advocates the complete suspension of immigration for two years, and Senator King of Utah proposes to prohibit immigration entirely for six months, while Congress is revising the law, and Chairman Johnson of the House Committee on Immigration and Naturalization now in session, favors temporary suspension of immigration during the legislative investigation.

Senator Sterling of South Dakota expects to introduce to Congress a bill creating a Federal Immigration Board to deal with all questions relating to immigration, including the right to decide the number of immigrants to be admitted.

Ole Hansen, former mayor of Seattle, has just returned from a study of economic conditions in England, France, Poland, Sweden, Germany and Denmark, and is convinced that it is necessary to greatly increase our barriers against immigration for several years.

Government data indicate that at least 12,000,000 people in Europe wish to immigrate to the United States and that the number actually arriving will soon equal the maximum record for the year ending June, 1914, when nearly 1,250,000 immigrants arrived.

Recent arrivals at Ellis Island include many that are sick, defective or otherwise undesirable, besides great numbers that are entirely destitute or have less than $10 in cash for their subsistence, to say nothing of paying their fares to their final destination.

In Canada, where immigrants of the right character are welcome and encouraged, they are required to possess a minimum sum of $250, plus their transportation, a regulation which seems to work satisfactorily there.

Anthony Caminetti, Commissioner General of Immigration, has sailed for a visit to Poland, Germany, Italy and the Balkans to investigate there immigration conditions so that he can advise Congress next term regarding legislation to alleviate hardships to immigrants losing their homes and purchasing transportation to this country only to find themselves inadmissible on arrival.

During the last fiscal year only about 10 per cent of the immigrants arriving from Europe settled in the Pacific Coast states, California, Washington and Oregon. Of these nearly two-thirds settled in California. Most of them arrived through the port of New York.

Foreign correspondents report that every seacoast city and town in the west and south of Europe is crowded with emigrants and that at least 5,000,000 Germans and Austrians are packed and ready to come to the United States as soon as possible. On one day the Polish foreign office received 311,000 applications for passports, according to reports.

An Italian syndicate with a capital of $700,000 has been organized in Rome to promote emigration and assist Italian emigrants, a large proportion of which will come to the United States. Special schools have been established to teach the emigrants to read and write foreign languages and to train them for occupations in their new homes.

Restricting Immigration

A bill that is intended to prevent the entrance into this country of excessive numbers of undesirable immigrants during the immediate future and to restrict those that do arrive to the most desirable class is now being prepared by a committee of the House of Representatives, Albert Johnson, chairman.

If this were all, the bill might be a desirable one, but it is so drastic as to exclude not only the undesirables, but almost all the desirables.

The bill will provide that immigrants can be admitted to the United States only after application in their behalf has been made by relatives who are citizens of the United States. Persons who had not been naturalized would not be permitted to bring in relatives under any circumstances.

These applications would have to guarantee that the immigrant was in good health, of good character and possessed of the proper financial and educational requirements for admission. If the application should be approved, a copy of it would be sent to the United States consul nearest the home of the immigrant, who in turn would appear at the consulate to have his passports vised.

The New Hampshire Commissioner of Labor will submit to the next session of the State Legislature a bill to amend the Workmen's Compensation Law so that injured workmen shall receive 66 2-3 per cent of weekly wage in case of injury, with maximum lump sum of $5,000 if permanently injured.

To Improve Newark Bay Area

The Chamber of Commerce of Newark, N. J., on November 18, adopted resolutions endorsing a plan for the expenditure of $1,025,000 by the city for deepening the channel in Newark Bay and filling in lands along the shore so as to give a 30-foot channel with a width of 300 feet from deep water in Kill van Kull to the mouth of Port Newark canal; also deepening and widening a similar channel in the canal to the government warehouses and making other improvements in the vicinity, including the use of the excavated material for filling in city lands covering an area of perhaps 100 acres. It is proposed that the city issue bonds to meet the cost of this improvement.

The Detroit United Railways have entered suit to prevent the city from acquiring municipal ownership of the street railway line.

Cleveland Street Car Fares Increased

Cleveland street cars, operating under the Taylor plan, are now receiving the maximum fares, which are 6 cents straight or nine tickets for 50 cents and 1 cent for transfer, which is only permitted when the interest fund of the Cleveland Railway Committee drops below $300,000. When it is above this sum the fare automatically drops.

Panama Canal Self-Supporting

Notwithstanding a recent change in the rules of measurement which reduced the toll income, the total receipts for the Panama canal for the fiscal year have exceeded the total operating expenses by $2,387,599, an amount which does not take into account the interest on the investment, which amounts to $367,151.66. The total expense during last year was $6,548,272, the receipts being $8,935,871.

Harbor and Waterway Improvement for 1921

It is estimated by Major-General Lansing H. Beach, chief of the army engineers, that work on the harbor and waterways improvements by the federal government during 1921 will require something over $78,000,000, this including about $11,000,000 for continuing contracts now under way. The largest item is $16,190,000 for the Mississippi river from its mouth to Minneapolis. For New York harbor and adjacent waters, $5,800,000 is asked, and $5,585,000 for the Ohio river, $3,857,000 for the Delaware river, $2,500,000 for the Delaware and Chesapeake inland waterway, and $2,115,000 for the Missouri river.

San Francisco Water Front Extensions

The chief engineer of the Board of State Harbor Commissioners of California, Frank G. White, states in a recent report that the water front of San Francisco has been developed practically to its capacity from the foot of Taylor street to the foot of Channel street. The logical location for further development is in the vicinity of Islais creek. The state has recently acquired, at a cost of about $850,000, sixty-three blocks of submerged land here which together with India Basin which adjoins the property, makes available an area of 280 acres of state-owned land capable of development. Five blocks of this have been reclaimed and wharves have been built along about half of the reclaimed area.

It is the purpose of the state board to develop on this property a water front terminal and industrial district. The land will be filled practically to the present water-front line and piers extended to the pierhead line. Wharf sheds, warehouses, railroad tracks and other structures will be provided. A depth of at least 34 feet of water at low tide will be provided for large ocean-going vessels. This will necessitate dredging the Islais creek channel, the slips between the piers and the areas north and south of the channel.

The increasing needs of shipping will necessitate this development in the near future. It is the purpose to make this development progressive, ultimately providing berths for 49 steamships each 500 feet long and for 6 vessels 300 feet long. The solid fill will be 1,060 feet wide and from 1,600 to 3,000 feet long, while the piers which extend to the pierhead line will be 330 feet wide and 1,100 feet long.

$5,000,000 Tunnel Bond Issue

The Bridge and Tunnel Commission in charge of the Hudson River-New York-New Jersey vehicular tunnel and the Camden-Philadelphia bridge, has ordered an issue of $5,000,000 thirty-year 6 per cent bonds of the $28,000,000 bond issue authorized.

Ontario's Electric Power Monopoly

The Hydro-Electric Power Commission of Ontario has recently bought out the only large private owner of such power in the province and thus secured practically a monopoly, becoming the largest generating and distributing power organization in the world. By 1922 the total investment of the associated Ontario municipalities will be nearly $170,000,000, and the total capacity more than a million horsepower. Eighty-four private companies have been bought and consolidated, the only one left in the province being that of Hamilton.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Sheeting Sewer Trenches

Wood and steel sheet piles. Driving by hand and bracing.

Sewer trenches through dry, hard or stony ground, clay or solid loam usually preserve the vertical faces long enough to permit the completion of the work without special protection to the sides. In most soils, except sand, where a trench can be excavated by power machines, the soil is likely to possess sufficient stiffness to stand up until the work is completed, or at least until sometime after the excavation has been finished so that sheeting, if any, is a simple matter.

In mud, silt, loose sand, or other unstable soil and in very wet soil, it is usually necessary to support the vertical sides of the trench as fast as the excavation is made, by means of sheeting or sheet piling and bracing. This is especially necessary in city streets or near foundations or other structures where it is essential to prevent settlement and displacement of the adjacent ground, especially where quicksand is encountered and may bleed through the cracks in the sheeting or may cause trouble by boiling up in the bottom of the trench.

In open field work if the trench is not too deep it is often permissible even in soft unstable ground, to disregard the condition of the sides of the trench and allow them to take their natural slope, excavating the material that slides in when this is cheaper, more rapid or more convenient than maintaining a narrow width at the top of the trench.

In many cases, however, it is imperative to provide some means of keeping the sides of the trench approximately vertical and preventing the displacement or settlement of the adjacent ground. If the ground is firm and solid and is not disturbed near the edges of the trench, it may stand safely until the excavation is completed, after which the vertical sides may be covered with planks held in position by longitudinal timbers called rangers, and by horizontal transverse braces engaging them; the planks may cover the entire surface of the vertical faces, or, if it is only necessary to prevent the initial movement of a firm stratum, they may perhaps cover only half the surface, with wide clearances between the separate planks. Usually the planks are placed vertical as a matter of convenience, but they can be placed horizontally if preferable. The lower ends of planks are usually adzed to a knife edge and the planks driven with mauls to penetrate a foot or two below the bottom of the trench and give them additional security.

If the soil is very loose and unstable it is necessary to sustain the sides of the trench as fast as the excavation is made or, generally, in advance of the excavation. For a small amount of work in dry ground and for moderate depth of trench, 2-inch square-edge planks from 8 to 12 inches wide and ordered to the approximate lengths required up to 16 feet, are suitable and can be driven by hand as the work progresses, keeping pace with the excavation. These planks closely aligned to form continuous walls on opposite sides of the trench will be true sheet piles and to secure proper alignment should be driven between a pair of rangers laid on surface of the ground and bolted together with fillers just wide enough to space them far enough apart for the planks to be entered.

At the beginning of operations a dozen planks, or any other convenient number, should be assembled together in vertical position between pairs of rangers on opposite sides of the trench, braced in position by stay laths if necessary, and working platforms made of planks laid on horses just adjacent to them on the outside of the trench should be provided to make scaffolds for men with heavy wooden mauls to drive the piles successively from first to last of each group, driving each pile a few inches as the excavation immediately in front of it is made, returning to the end of the line and repeating the operation again and again as the excavation is extended downward. The men in the trench should take particular pains to excavate or loosen the earth around the feet of the piles and especially to remove any stones or obstructions that may be encountered, so that the piles can be driven with minimum effort, keeping the lower ends below the surface at all times.

As the excavation advances, the lines of rangers are extended, additional groups of sheet piles are assembled and driven between them, and so on,

until the first piles are driven to the bottom of the trench while others are continually added in front as the trench advances.

After the trench has been excavated to a depth of from 2 to 6 feet below the surface (according to character of ground), the inner rangers are braced apart by transverse struts usually about 10 feet apart, held in position by cleats nailed to the rangers. A second tier of rangers is laid on the bottom of the excavation, against the opposite faces of the sheet piles, and is braced in a similar manner but in longer panels, until the excavation has been carried down below the cross braces and additional braces can be inserted without too much obstructing the work underneath. Successive courses of bracing are thus added as the trench grows deeper and deeper until, according to the character of the ground and the depth, the pressure may be so great as to require braces only 2 to 3 feet apart vertically, and 5 or 6 feet apart horizontally, which is about as close as practicable, and is very expensive. If these prove inadequate for very heavy pressures the sizes of the rangers and bases may be increased, seldom or never to exceed 12 x 12 inches.

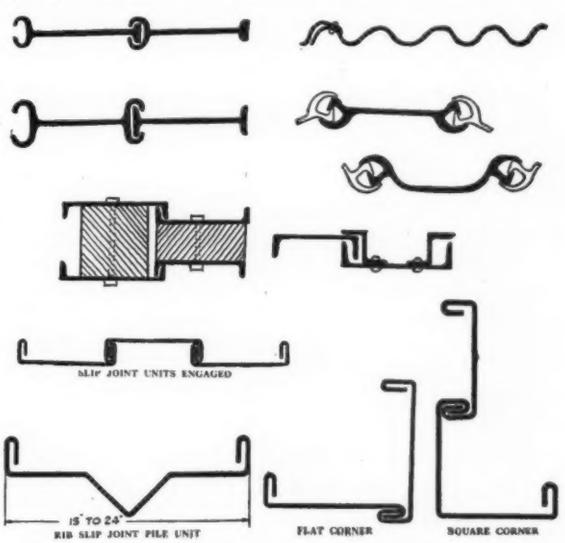
If the trench is more than about 14 or 15 feet deep it will usually be necessary to start it a foot or two wider than is required at the bottom, and when it has been excavated nearly to the bottom of the first tier of sheet piles, to start a second tier of piles parallel to the first and on the inner face of the lower ranger, driving them down as already described in short successive operations as the excavation proceeds. The advantage of the second tier of sheeting is in the shorter, cheaper and more convenient lengths of piles and on account of the facts that the friction of driving is greatly increased with the length of the pile and that all of the friction of the first tier of piles is eliminated when the second tier is commenced.

If there is so much ground water that it is necessary to exclude it by the sheet piles, care must be taken to drive them with their adjacent edges as closely as possible in contact. They are sometimes driven with tongue and groove or with splined or ship-lap joints, all of which are useful if they are successfully installed, but all of them are the weakest parts of the units, and are liable to injury and destruction in driving.

It is also difficult to keep the piles in alignment below the surface, and the joints are liable to be broken or disengaged and the piles to get out of the vertical plane, sometimes opening large gaps between them if special care is not taken with inspection and correction. In such cases the lower ends of the piles are often beveled so as to cause them to draw against the last-driven pile, and sometimes guide blocks are wedged close to their forward edges and secured between the rangers to hold them very securely while being driven. If the soil is clear and free from obstructions such as gravel, boulders, logs and portions of old structures, it is possible with care to drive the piles uniformly and in good engagement; but if serious obstructions are encountered they are likely to destroy or deflect the piles and driving at the obstructed point has to be stopped until the excavation reaches the obstruction and it can be removed, while sometimes it is necessary to drive another auxiliary group of piles to enclose the obstruction and connect with the regular line before and behind it.

Where very much ground water is encountered or the sides are very unstable it is often desirable to drive the sheet pile full length before commencing excavation. For this purpose it is always necessary to use mechanical devices, generally light hammers operated by steam or compressed air. Although drop hammers operated by a hoisting engine can be used, they are not usually as advantageous, portable or efficient. Air or steam hammers are also frequently provided on large jobs where piles are driven only as the excavation advances, one small air hammer requiring a single man to operate it, being much more rapid and effective than hand work, requiring several men with mauls.

Where there are many obstructions in the ground, or where the strata are very hard or for any other reason the driving is difficult; where the piles are very long, or where the earth pressure seems to be very great, or it is necessary to provide a high degree of water tightness, or where the piles are to be pulled and redriven many times, it is generally advantageous to use interlocking steel piles. These may be of any of the standard makes on the market, which, however, are limited in number and can be had in only a few sizes, which, being required to meet all conditions, are necessarily designed to endure the heaviest driving and are therefore generally extravagantly heavy and expensive. Most of them are provided with a very substantial interlock that insures the engagement of successive units unless subjected to very severe treatment, but does not insure water tightness. The joints, however, are likely soon to become filled with silt or sand so that the flow of water through them is likely to diminish rapidly. Most of the rolled sections of steel sheet



PRINCIPAL TYPES OF STEEL SHEET PILES
The units made with channel bars are seldom or never used for sewer trenches.

piles weigh from 20 to 40 or 50 pounds per linear foot, are heavy to handle and require special equipment for their installation. They can be set by a locomotive crane, traveling derrick, stationary derricks or small gantries, the latter sometimes being designed to span the sewer trench and provide for driving or pulling piles on both sides simultaneously.

Sheet piles fabricated from single pieces of sheet steel cold-bent to a channel-shape cross-section with double flanges are free from many of the objections to rolled pile sections, and possess many advantages that the latter do not, particularly the remarkable flexibility enabling them to be selected to closely fit varying conditions on account of the fact that all of the dimensions and their weight and strength can be varied at will without involving delay or extra expense in their fabrication so that a light pile of great strength can easily be secured for hard driving and a still lighter pile, weighing as little as 3 pounds per square foot, can be provided for easy driving.

The piles may thus be selected to conform to each particular job and may be so light and cheap that it is economy to leave them permanently in the ground after serving their original purpose, or strong enough to be pulled and redriven again and again a great number of times. The interlock is easy and perfect and the reduced weight, very seldom being more than 10 or 12 pounds per square foot for the heaviest unit, effects a great economy in transportation and handling besides the original saving in purchase.

Another great advantage possessed by these piles is the special method of installation with removable driving bars that enables them to be driven without injury through very hard ground or ground containing logs, boulders and other obstructions. This method may be applied without additional cost to piles intended for ordinary driving. If unexpected conditions require the piles to be longer than have been provided, the lighter weights can be advantageously spliced in the field at small expense.

130-Pound Rails for Pennsylvania Railroad

In 1875 the Pennsylvania Railroad laid 60-pound rails, substituting 70-pound for these in 1884, adopting a 75-pound rail in 1886, and 85-pound in 1887. Rails weighing one hundred pounds to the yard were first laid by this railroad in 1892. Figures compiled in November of this year show that on October 1 that railroad had replaced 44 per cent of the main line trackage in the New York, Philadelphia, Baltimore, Maryland and middle divisions and at the Philadelphia terminal with 125-pound and 130-pound rails; the total mileage so replaced being 705, of which 46.9 miles is in the Philadelphia terminal, and 166 miles in the New York division.

The constantly increasing weights of locomotives and cars and the strain of constantly increasing traffic decided the company to adopt these heavier rails, the company's experts after six years of experimenting with and studying these rails having concluded that their use would insure a greater degree of safety and longer life for the rails.

Municipal Electric Light, Heat and Power Plant for Newark

The voters of Newark, N. J., recently authorized the officials to construct a municipal gas and electric light, heat and power plant and Director Raymond of the Department of Streets and Public Improvements is taking steps to carry out these instructions. Among other moves he has asked F. W. Ballard of Cleveland, Ohio, to visit Newark for consultation and for explaining before the Federation of Improvement Associations what he has done in Cleveland. (Mr. Ballard, as commissioner and chief engineer of the Division of Light and Heat of Cleveland, was chiefly responsible for the success of the municipal lighting plant of that city.) The Chamber of Commerce of Newark announces its intention of instituting legal proceedings to prevent the construction of a municipal plant, it having been informed that the project would cost several million dollars and that the city's financial condition would not permit the raising of the necessary amount.

Salaries of Philadelphia Employees

The Bureau of Municipal Research and other civic organizations of Philadelphia are urging the city authorities to increase the pay of its employees, both in justice to them and in order to secure and retain a desirably high grade of services. While the cost of living has increased more than 100 per cent since 1914, the general level of city pay has increased about 43 per cent. "If the city government were to pay its employees according to standards that obtained in 13 other large cities in the United States in 1914 and 1915, it would have to raise the general level of city pay at least 55 per cent," while local private establishments in 1915 were paying at least 18 per cent more than the city.

The Bureau of Municipal Research has published a table comparing the average annual compensation of employees in the city service with those occupying similar positions in private service in that city. These include electrical, mechanical and structural engineers, blacksmiths, chauffeurs, nurses, office boys, etc. In every case the city pay is less than private pay by from 7 to 98 per cent. The city pays a senior electrical engineer $2,300 as compared to $3,600 for similar services in private employ. Survey engineers receive $4,500 as compared to $6,240, assistant structural engineers are paid $2,556 by the city and $3,033 by private employers, laborers receive $1,118 and $1,258 in the two services, respectively. "This condition of underpayment . . . is unfair to the employees of the city and it is ruinous to the efficiency of the service. . . . The Bureau of Surveys is unable with its depleted corps of technical men to keep abreast with its important current work."

Recent Legal Decisions

PUBLIC SERVICE COMMISSIONS' POWER OVER WATER SERVICE AND RATES

In actions to recover payments claimed under contracts to supply water for hydrants to two boroughs, the New Jersey Supreme Court holds, Hackensack Water Co. v. Tenafly and Ridgefield, 111 Atl. 261, that under the State Public Utilities Act the terms of the contract between the water company and others, including municipalities, are determined by the public utility commission. It has power to prescribe the character of the service to be furnished, as well as to prescribe the rates to be paid. It is open to municipalities and to individuals to accept or reject the service at these rates. If they accept, as the municipalities did in this case, they accept the terms as prescribed by the commission, which necessarily means the character of the service as well as the rates of payment. Where suit is brought for the contract price, the only question open is whether the utility has furnished the service prescribed. It is not open for a court or jury to find that other facilities than those prescribed by the commission would be adequate, or that the facilities furnished, if in compliance with the order, are inadequate. In order to preserve uniformity and avoid the discrimination forbidden by the act it is essential that the commission control this question of service and rates. This is the effect of the decision in the United States Supreme Court dealing with interstate commerce cases. Until the commission has determined what facilities are adequate, no action can be brought or defense made where there is a controversy on the point. In the present case the commission has determined what facilities are adequate and what the price shall be; the only question left open is whether these particular facilities as prescribed by the commission's order have been actually furnished. So far as the defendant's defense did not question the rate or aver that the facilities prescribed by the order of the commission were not adequate, but merely stood on the commission's order and denied that the plaintiff had performed, they were held sufficient.

CONTRACTOR'S PAVING GUARANTY CONSTRUED

In a suit on tax bills issued by a city for sidewalks, the defendants contended that the guaranty contained in the paving contract that the work should be constructed with such materials and in such manner that it would endure without any repairs for seven years after completion and acceptance, bound the contractor to so construct the pavement that it would not need repairs for seven years in any event, and that if, in order to do so, it was necessary to use for flushing a compound containing a larger percentage of cement than that which was used, the contractor was bound to use such a compound. The Missouri Supreme Court holds, Schropp v. Zeilda Forsee Inv. Co., 224 S. W. 424, that this guaranty does not go to that extent. It merely operates to bind the contractor to make such repairs as may become necessary within the time fixed in the contract. The fact that repairs may be needed within less time than seven years during which the guaranty runs imposes an obligation on the contractor to make the repairs without charge, but does not vitiate the tax bills which have been issued for the work already done.

FRANCHISE EXCEEDING AUTHORIZED PERIOD VOID IN TOTO

The Kentucky Court of Appeals holds, Hamilton v. Bastin Bros., 224 S. W. 430, that the provision of the Constitution of Kentucky that no municipality shall grant any franchise or privilege for a term exceeding 20 years is mandatory and cannot be evaded or disregarded in any material particular. A franchise to construct and operate an electric lighting system, granted by a city to purchasers from and after the passage of an ordinance of September 23, 1916, continuously until July 1, 1917, and for the additional term of 20 years thereafter, is held violative of the Constitution, in its inclusion of the period of 9 months and 7 days up to July 1, 1917, though such excess time over 20 years was merely given the purchasers of the franchise for construction, and not for operation, of the plant. The purchasers had the right to abandon the franchise at any time, and were not obliged to operate their plant throughout the period limited by the franchise.

CONSTRUCTION OF ROADS BY SPECIFIED ROUTES

The West Virginia Court of Appeals holds, Haws v. County Court of Wayne County, 104 S. E. 119, that voters, in the issuance of bonds for the purpose of raising funds for the construction or improvement of public roads, may place upon the expenditure of such funds any limitations or restrictions not forbidden by the fundamental law, and the authorities charged with the expenditure of such funds will be enjoined from diverting the same to any other purpose than that to which they are directed to be applied by the terms of the grant. This applies to the construction of a road by an unnecessarily devious route, different from a practicable route specified in the grant.

JUDICIAL DEFINITIONS OF "GRADING" STREETS

To grade a street or highway, strictly speaking, is to establish a level by mathematical points and lines, and then to bring the surface of the street or highway to that level, by the elevation or depression of the natural surface to the line as fixed. Gas & Electric Securities Co. v. Manhattan, etc., Corp., 266 Fed. 625. In Sedgley Avenue, 217 Pa. 313, it is said that "as a matter of fact the grading of a street is its physical opening." Then, the court adds, when the city is in funds, the physical grading is done, and sewers and water pipes and gas pipes are laid as part of the work.

NEWS OF THE SOCIETIES

Dec. 27-Jan. 1—AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Smithsonian Institute, Washington, D. C. Chicago, Ill.

Dec. 28-31—AMERICAN ECONOMIC ASSOCIATION. Yale Station, New Haven, Conn. Atlantic City, N. J.

Jan. 19 — INTERNATIONAL CUT STONE CONTRACTORS' AND QUARRYMEN'S ASSOCIATION, Inc. Annual meeting. Congress Hotel, Chicago, Ill.

Jan. 19 — AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25, 26, 27—ASSOCIATED GENERAL CONTRACTORS. Annual meeting, New Orleans. Secretary's Office, Washington, D. C.

Feb. 1-2—NEW YORK STATE ASSOCIATION OF BUILDERS. Convention. Rochester, N. Y.

Feb. 1, 2, 3, 1921—ONTARIO PROFESSIONAL MEETING in conjunction with the annual meeting of the Engineering Institute of Canada. Toronto.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

June 7-9—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

June 6-10, 1921—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Cleveland, Ohio. Secretary, J. M. Diven, 153 West 71st St., New York.

FEDERAL HIGHWAY COUNCIL

Why highways fail was taken up by engineers, highway officials and scientific men in leading universities at a meeting of the sub-grade committee of the Federal Highway Council, held at Wilmington, Del., November 22 and 23, under the chairmanship of General T. Coleman Du Pont of New York.

Among the scientific men attending were Professor Hector J. Hughes, dean Harvard Engineering School, Cambridge, Mass.; A. T. Goldbeck, testing engineer, Bureau of Public Roads, Washington, D. C.; Professor F. H. Eno, chair of engineering, Ohio State University; H. E. Hilts, of the Pennsylvania State Highway Department; H. G. Shirley, of the Federal Highway Council, and Ira B. Mullis, Bureau of Public Roads, Washington, D. C.

Reports were made by problem committees working under a main committee. During the discussion which followed, W. P. Blair, of Cleveland, Ohio, stated that twenty million people had been added to the population of the United States, practically without one inch being added to the transportation facilities of the country, and that on top of this increased population was an increased tonnage due to greater buying by the people equal to another twenty million, making a total of practically fifty million, in the face of inadequate transportation. The result of this increased tonnage, it was asserted, had been to break down roads through no fault of construction, but because traffic growth had not been taken into full account.

The development of railway engineering was used as an example to show why heavier type highways must be built, since the same law of tonnage growth applies to both the railway and the highway. In the case of the railway, Mr. Blair asserted, the laying of heavier rails, enlarging tunnels and reducing grades, has been going on constantly during the past thirty or forty years, and yet the highway, without a comparative development, had been called upon within the last ten years to sustain a traffic growth unequaled in any like period in the history of the country. The situation this created, it was pointed out, called for a determined effort to build better road foundation in order that breaks in the surface may be eliminated.

General Du Pont said that it was his belief that the foundation problem must be solved and solved speedily, otherwise the movement to round out a complete system of county, state and interstate highway transportation will be retarded to the great detriment to the American public.

C. M. Upham, state highway engineer of Delaware, explained how his department was making field tests to determine the bearing power of various kinds of soils and what methods to pursue in order to increase that sustaining power and thus prevent the breaking down of the road surface.

On the point of road failures, Mr. Shirley, former state highway engineer of Maryland, called attention to the fact that roads are sometimes charged with having failed, despite the fact that in actual service they may have saved their cost many times over before reaching the point where reconstruction becomes necessary.

S. M. Williams, chairman of the Federal Highway Council, addressed the committee briefly upon the importance of conducting the sub-grade research work as rapidly as possible in order that road building upon a greater scale than ever before may go forward without wasteful expenditure of funds.

Investigations in widely separated sections of the United States are to be conducted simultaneously and reports made at subsequent meetings of the sub-grade committee. The work is under the direction of the Federal Highway Council, which hopes, through the movement now undertaken, to save millions of dollars to the public in the future in the construction of roads that will not fail.

THE ENGINEERS' CLUB OF PHILADELPHIA

On December 21, at 8:15 p. m., this club will hold a meeting in its auditorium on the subject of "Road Construction for Heavy Truck Traffic." A number of prominent authorities, including state highway commissioners, will be present and papers will be read and a general discussion had on the subject in order to bring out information of practical value.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The forty-first annual meeting of the American Society of Mechanical Engineers was held December 7-10 in the Engineering Societies Building, New York City. On Monday morning, December 6, were held the conference of local sections' delegates, and the meeting of the Committee on Power Test Code. On Tuesday afternoon, December 7, there were simultaneous sessions of the fuel section, the forest products and the machine shop sections. On Tuesday evening were the report of tellers of election and the introduction of the president-elect, the presidential address, the conferring of six honorary memberships, and the presidential reception and dance.

The regular business meeting took place on Wednesday morning, at which time amendments were made to the constitution, and reports given by standing committees, and the committees on code of ethics, industrial relations, education, feedwater-heater standardization and the sub-committee on bearing metals.

On Wednesday afternoon were the meetings of the management and railroad sections, and on Wednesday evening the Brashear Memorial, at which an oration on the life and work of the late Dr. John A. Brashear, past-president of the A. S. M. E., was delivered by Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching.

On Thursday afternoon, December 9, were the organization meeting of the ordinance section and the Ladies' Tea and Dance.

On Friday morning were held meetings of the textile and power sections. The subject of the power session was "Future Power Development," and papers were presented on the "Policy of Future Power Development," "The Effect of Load Factors on Cost," "The Effect of Size of Plant and Cost," and the "Financial and Legal Aspects of Future Power Development."

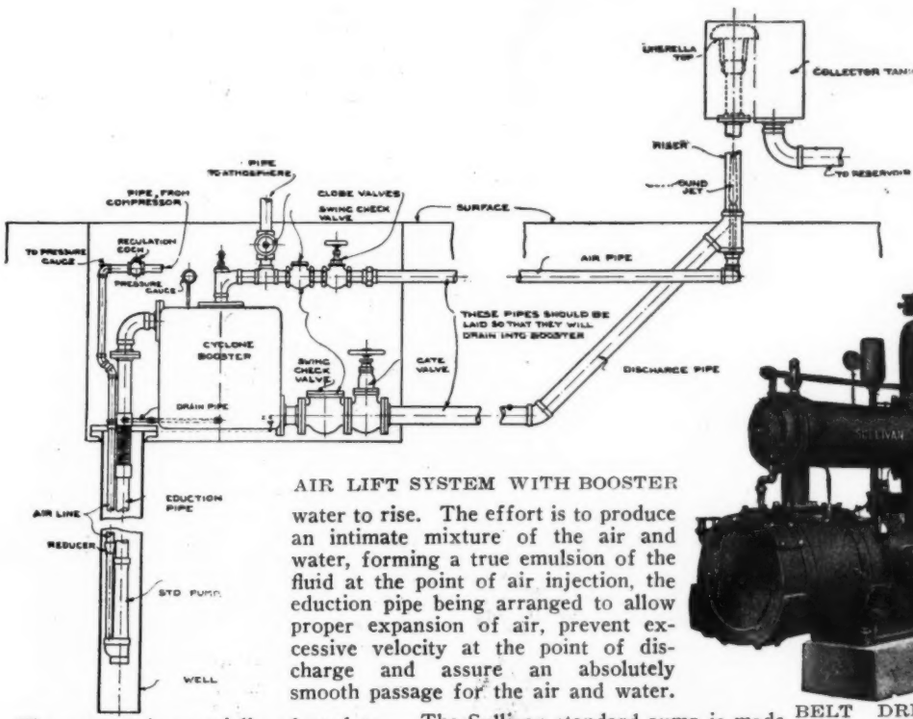
The keynote session on transportation was held on Thursday, December 9, when the subject was ably treated by well-known authorities in the field. The railroad situation was considered from two points of view, that of the railroads themselves, discussed by Daniel Willard, president of the Baltimore & Ohio Railroad, and that of the Development of Railroad Feeders, which was discussed by Charles A. Morse, chief engineer of the Chicago, Rock Island & Pacific Railroad. The Importance of Waterways in Transportation was taken up by Gen. Frank T. Hines, and that of Motor Truck Transportation by Francis W. Davis, engineer, Pierce-Arrow Motor Car Co. The question of Terminals in General was presented by Col. William Barclay Parsons, consulting engineer, New York City, and that of the New York Terminal Problem by Gustav Lindenthal, consulting engineer, New York City.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

SULLIVAN AIR LIFT PUMPING SYSTEM

The principles of elevating water and other liquids by the air lift method are discussed, and the apparatus for this purpose is illustrated and described in Bulletin 71-D issued by the Sullivan Machinery Company, which employs a separate corps of engineers devoted entirely to problems relating to pneumatic pumping, to which is applied a successful experience of more than 25 years of manufacture and installation.



AIR LIFT SYSTEM WITH BOOSTER

The principle involved is the introduction of air under pressure greater than the hydrostatic head, into the foot of the discharge pipe through which the water rises to the outlet or reservoir. The theory of operation is that the introduction of air into the water reduces the specific gravity of the mixture so that an unbalanced pressure is developed that causes the mixed air and water to rise. The effort is to produce an intimate mixture of the air and water, forming a true emulsion of the fluid at the point of air injection, the eduction pipe being arranged to allow proper expansion of air, prevent excessive velocity at the point of discharge and assure an absolutely smooth passage for the air and water.

The process is especially adapted to deep well pumping and the principal advantages include the delivery of more water from the same wells than by any other system; improvement in the character of the water as to purity and solubility due to aeration; reduction in temperature due to absorption of heat in the water by the air; absence of moving parts in the well, and freedom from injury or obstruction by mud, silt, sand or long shut-downs; all of them operating to keep the apparatus always in order and to provide sustained efficiency.

The expansion of the air in the uptake pipe of the lift absorbs heat from the water and lowers its temperature, thus affording an important advantage, especially in water used for condensing purposes.

It is claimed that the air lift installation is more durable and requires less attention and repairs than any other method of pumping, no farther attention being necessary after the installation has been properly adjusted in the well.

The essential feature of air lift pumping is in the introduction of air, under pressure greater than the hydrostatic head, into the foot of the discharge pipe through which the water rises to the outlet or reservoir. The theory of operation is that the introduction of air into the water reduces the specific gravity of the mixture so that an unbalanced pressure is developed that causes the mixed air and water to rise. The effort is to produce an intimate mixture of the air and water, forming a true emulsion of the fluid at the point of air injection, the eduction pipe being arranged to allow proper expansion of air, prevent excessive velocity at the point of discharge and assure an absolutely smooth passage for the air and water.

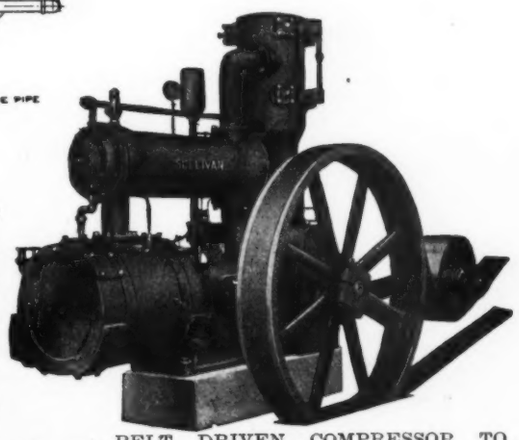
The Sullivan standard pump is made of bronze with an air passage leading from the outside, terminating in a perforated vertical tube below a Venturi or throat so that the air is broken up into small jets automatically providing a larger or smaller proportion of air according to the lift, without change in the pump opening, so that the mixing tube receives the sand and scale and prevents them from clogging the perforations. The remainder of the apparatus is made up of standard pipes and simple fittings and is operated with air provided by a suitable compressor selected from a number of sizes and types illustrated in the bulletin.

By the use of a "Cyclone" booster or separator system, in which the water from the well is discharged by the high velocity to the booster tank where it acquires a downward centrifugal action that completely separates it from the air and is subjected to the required pressure, it may be forced to the desired additional height.

The bulletin gives a number of valuable tables of the dimensions and capacities of pumps, pipe sizes, thicknesses, weights and fittings, capacities of cylinders, loss or head of water in pipe due to friction, h. p. required for air compression, flow of air through orifices and cylinder piston displacements.

FLEXATILE EQUIPMENT PAINT

The Hepps roofing division of the Richardson Company has issued a circular making a special offer to contractors to furnish in metal barrels, half barrels and cans, especially prepared asphalt paint to preserve contractors' equipment. This paint is intended to be used on plant laid up for the winter, and is offered at a reduced rate.



BELT DRIVEN COMPRESSOR TO OPERATE AIR LIFT

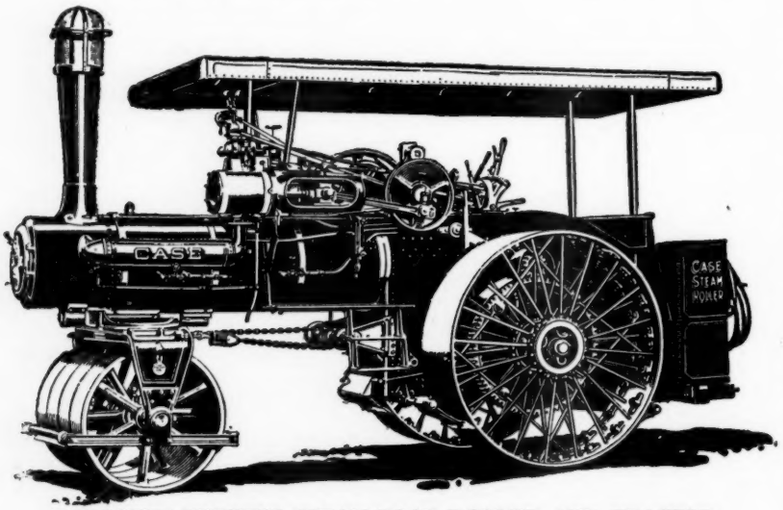
BENJAMIN-STARRETT STANDARDIZED PANEL BOARDS

The sectional unit panel board made by the Benjamin Electric Manufacturing Company and described in catalog F-3 is designed for all standard arrangements of bus bars and main connections, and is adaptable for increased mains, sub-feeds, and through feeds, with regular listings of four to thirty circuits. The boards have a moulded composition base electrically and mechanically superior to slate and weighing one-half as much, behind which the bus bars are concealed, leaving the front of the board of a reduced size, clear for a better spaced assembly of fusing and switching arrangements.

The panel bar is made up of interchangeable unit panel sections that are carried in stock and can be ordered by catalog numbers to great advantage, eliminating delay and unavoidable expense due to detail specifications and special construction.

CASE ROAD BUILDING MACHINERY

Tractors manufactured by the J. I. Case Threshing Machine Company, Incorporated, are offered by them for general service in road building operation. The steam tractors are made in eight sizes of 30, 40, 50, 60, 65, 75, 80 and 110 h. p., while the kerosene tractors are made in four sizes of 10-18, 15-27, 20-40 and 22-40 h. p. The features for which special merit is claimed include the four-cylinder valve-in-head motor that burns kerosene economically and will stand severe service, liberal reserve in excess of rated h. p.; simple and durable type of transmission with all cut-steel spur gears; dustproof and oiltight housings for all vital working parts; unusual accessibility; high tension, dust and waterproof magneto that requires no battery, and suitability for all kinds of draw-bar and belt work. There is a rigid main frame with cannon bearings for the drive wheel axles, the wheels may be provided with detachable lugs and with extension rims.

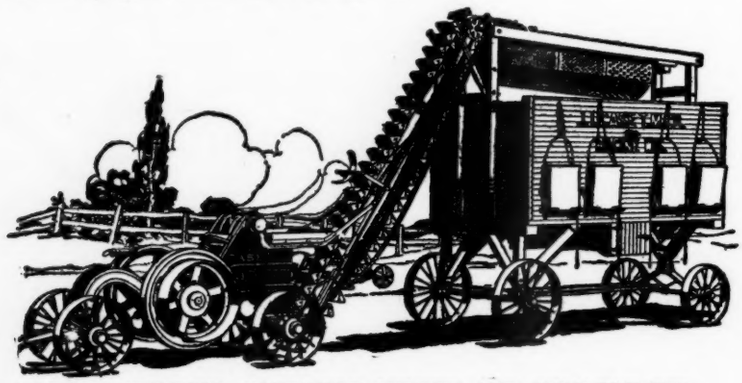


KEROSENE BURNING STEAM ROAD ROLLER AND TRACTOR

The road rollers are built in 10-ton and in 12-ton sizes with large fuel and water capacity and short wheel base. Like the tractors, they are provided with driving pulley for belt operation of other machinery, such as a rock crusher, concrete mixer or large pump.

The roller makes an efficient tractor for slow, heavy work. It is provided with a friction clutch and differential gears, and has scrapers on both front and rear rollers. The rear axle has cannon bearings and the engine and boiler are provided with spring mounting. They have an especially simple and efficient valve gear and a power steering device that turns the front roller whether or not it is in motion.

Detachable taper spikes protruding 4½ inches are provided for the rear roller for use in loosening old roads and can be inserted or removed in twenty minutes. The front rolls are made in four sections 12½ inches wide and 41 inches in diameter, enabling the machine to turn around in a 24-foot circle.


ROCK CRUSHER, ELEVATOR SCREEN AND MOVABLE BIN

Case rock crushers are made in size "A" with an 8x16-inch jaw opening and capacity of 10 to 16 tons per hour and with the elevator and screen are operated with a 20 h. p. engine. Size "B" with a 10 x 28-inch jaw opening and a capacity for 15 to 25 tons per hour has a 30 h. p. engine and a shipping weight with elevator of 14,900 pounds. The standard cylindrical screens are perforated with ½-inch, 1¼-inch and 2½-inch diameter holes and are served by bucket elevators. The standard size bin has a capacity of 15 tons, and is divided into four compartments, each of which has two loading spouts, one on each side.

PERSONALS

Hepburn, Donald M., at one time chief of the Bureau of Street Cleaning, and later chief of construction of the Pennsylvania State Highway Department, has resigned the latter position to take one in New York state.

Voyles, Fred, has been appointed county highway commissioner of York county, Neb., to succeed his brother, Glenn I. Voyles, who resigned to accept a position with the Western Bridge Co., of Omaha, Neb.

Mitchell, McClain, superintendent of public improvements of Paducah, Ky., has been appointed city engineer.

Arnold, Ralph R., county engineer of Contra Costa county, Cal., has been appointed highway engineer.

Watkins, Vaughn, of Jackson, Miss., has been appointed state highway commissioner of Mississippi.

Moisseiff, Leon S., designing engineer for the New York Department of Bridges during the construction of the Williamsburg, Manhattan and Queensborough bridges, has been appointed consulting designing engineer on the technical staff for the engineering investigation of the proposed bridge over the Delaware river, between Philadelphia and Camden.

Wilson, H. Lee, assistant city engineer of Johnstown, Pa., has been appointed city engineer to succeed Jackson R. Crissey, who has resigned.

Meloy, Bruch L., formerly field engineer of Johnstown, Pa., has been appointed assistant city engineer.

Biggs, Dr. Hermann M., health commissioned of New York state, has temporarily assumed the duties of general medical director of the League of Red Cross Societies, Geneva, Switzerland.

West, W. C., formerly resident engineer on work on the Dixie Highway north of Toledo, Ohio, is now assistant district engineer at Saginaw, Mich.

Dawson, J. B., formerly division engineer of District 9, Kentucky State Highway Department, has been appointed maintenance engineer.

Foster, C. F., assistant district engineer of bridges, central and southwestern districts, Michigan State Highway Department, has been appointed district engineer for the west central portion of the state with headquarters in Grand Rapids.

Bailey, S. M., formerly resident engineer for the Department of Public Works, Kentucky, has been appointed to a similar position with the North Carolina Highway Commission.

Symons, Col. Thomas W., Corps of Engineers, U. S. A., for thirty years in service with the government, died on November 23 at Washington.

Leidl, Edward F., chief engineer of sewers, Milwaukee, Wis., since 1914, died on November 21.

Goodbody, Richard H., formerly superintendent of streets, San Diego, Cal., died in that city on November 20.

Cassidy, Roger, has resigned as road engineer of Fleming county, Kentucky.

Henderson, R. H., now mayor of San Angelo, Tex., has been appointed city manager.